Services for Distributed Online Data Repositories

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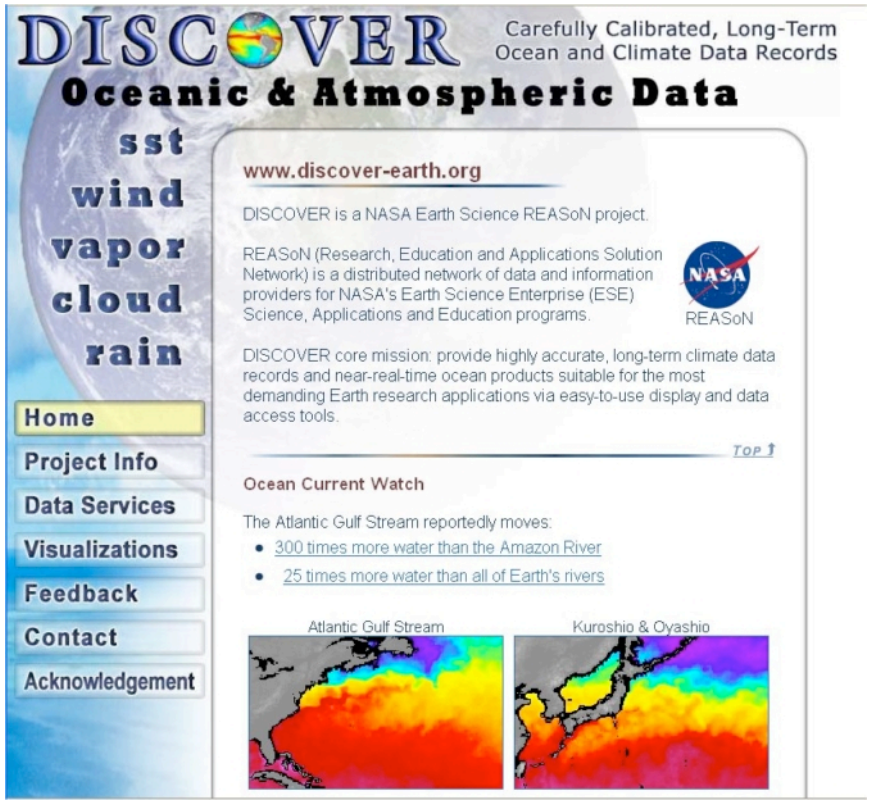
Distributed Information Services: Climate/Ocean Products for Earth Research (DISCOVER)

- A REASoN collaboration between Remote Sensing Systems, NASA/MSFC and the University of Alabama in Huntsville
  - 5 year project starting April 2004
- Science goals
  - Multi satellite inter-calibration and cross-validation
  - Highly accurate, long term ocean and climate products
- IT goals
  - On-line services for data access and visualization
  - Interoperability technologies for improved data usability
  - Flexible architecture to adapt to changing user requirements



http://www.discover-earth.org/

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Key Personnel

- Project Coordinator
  - Michael Goodman – Co-I, NASA/MSFC
- Atmospheric Science
  - Frank Wentz – PI, RSS
  - Roy Spencer – Co-I, UAH
- Information Technology
  - Sara Graves – Co-I, UAH
  - Helen Conover – technical lead
  - Ken Keiser – data pool development

http://datapool.nsstc.nasa.gov

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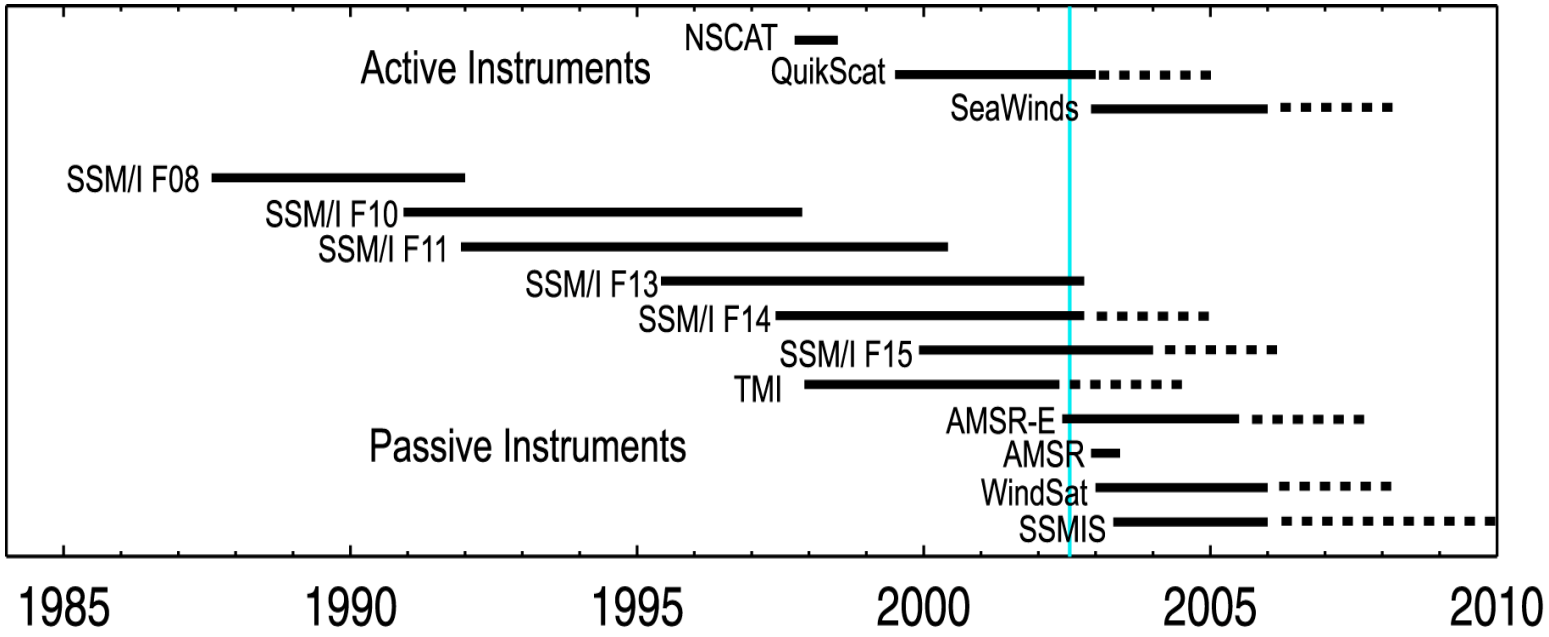
Long Term Systematic Measurements

Merging multiple sensors from multiple platforms into geophysical data sets consistent in both space and time to produce highly accurate, long-term ocean and climate products

- 27 microwave satellite instruments from the past, present, and future



Periods of operation for microwave instruments that can retrieve ocean surface winds

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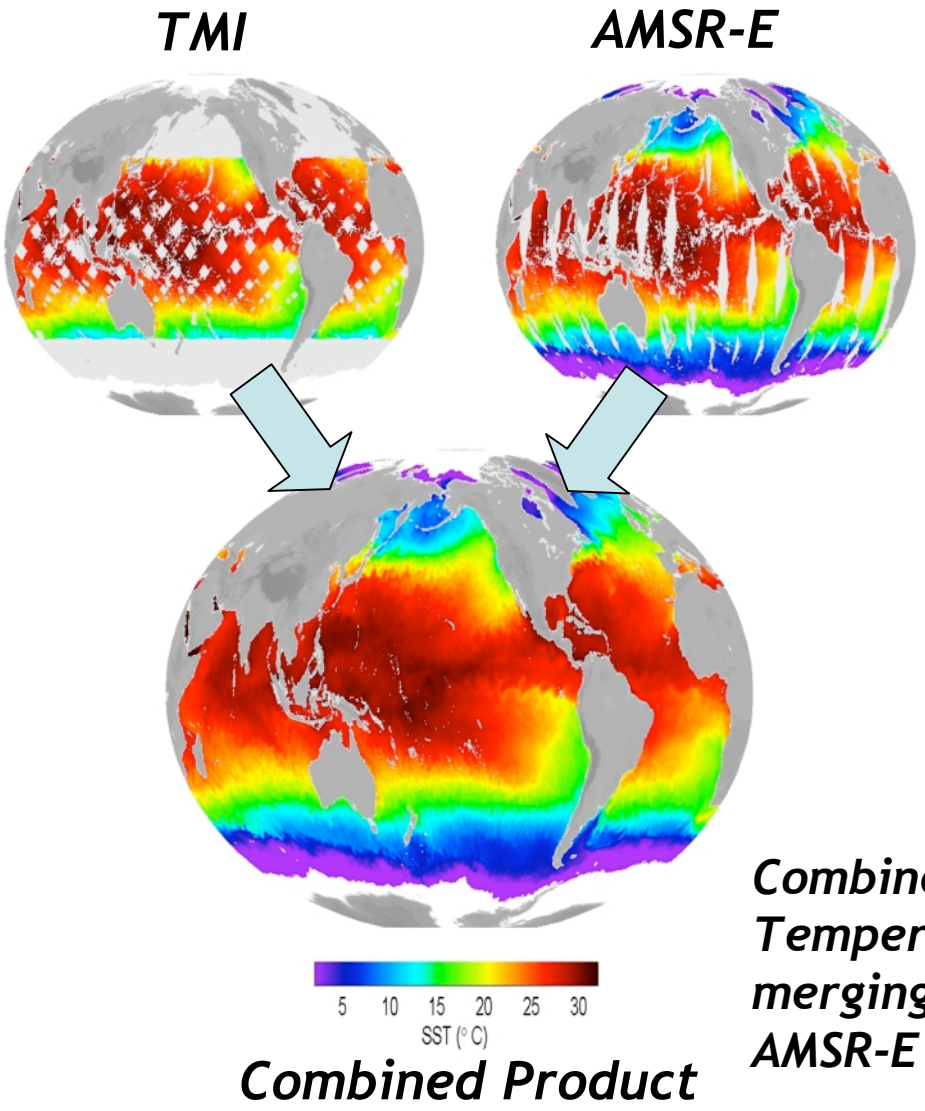
DISCOVER Data Products



Combined Product

Data products include:

- Brightness temperatures
- Sea surface temperature
- Wind speed
- Air temperature
- Atmospheric water vapor
- Cloud liquid water
- Rain rate

Combined Sea Surface Temperature product merging data from TMI and AMSR-E available now

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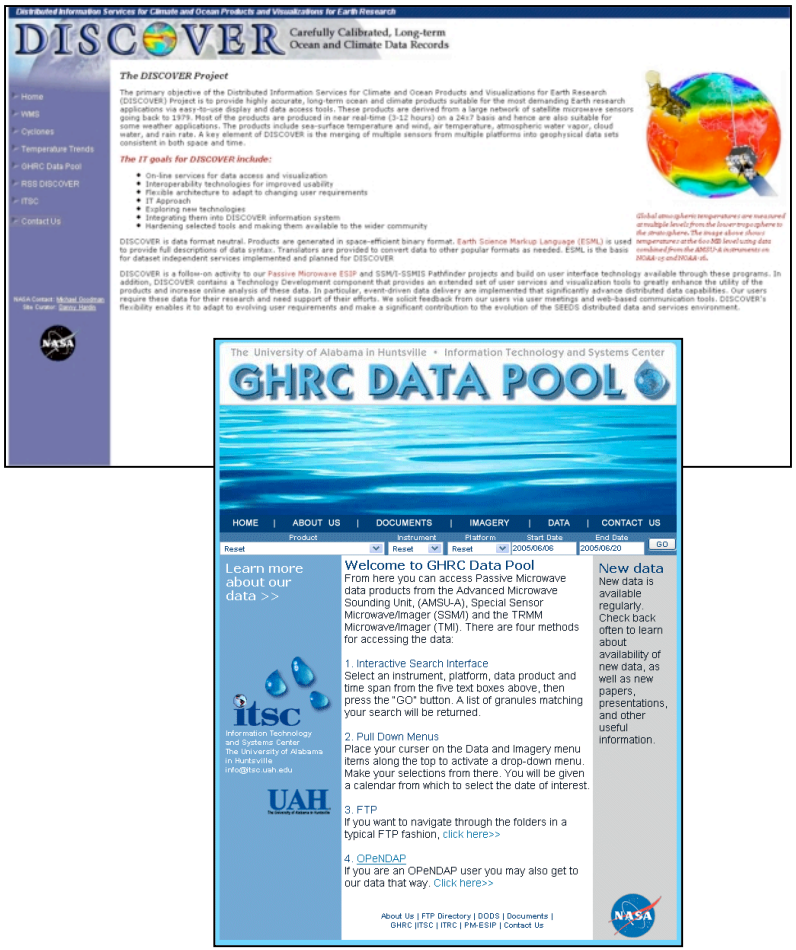
IT for DISCOVER

- IT goals
  - On-line services for data access and visualization
  - Interoperability technologies for improved usability
  - Flexible architecture to adapt to changing user requirements
- IT Approach
  - Exploring new technologies
  - Integrating them into DISCOVER information system
  - Hardening selected tools and making them available to the wider community



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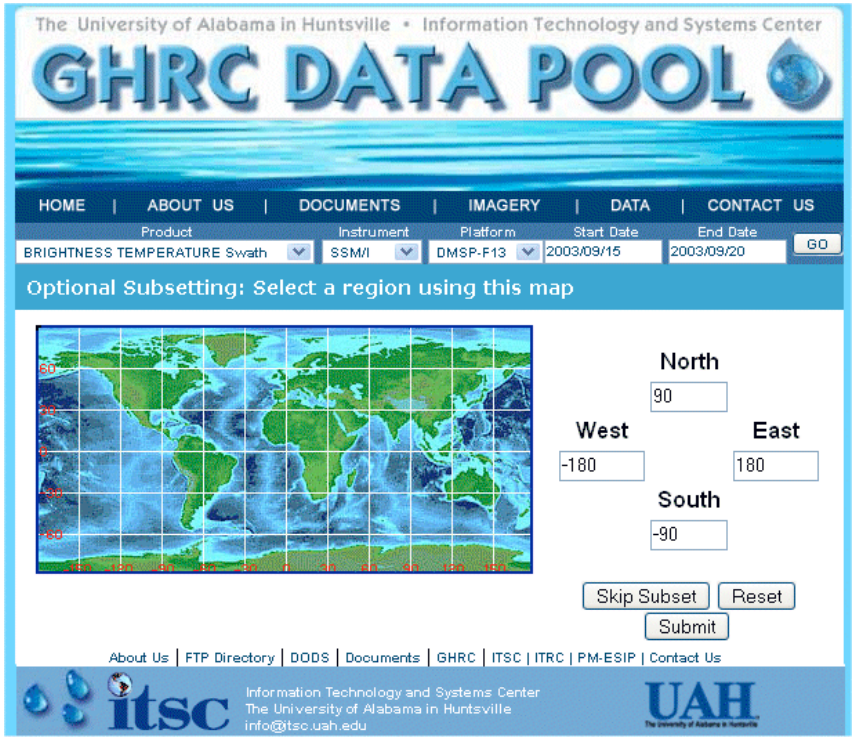
Data Management Objectives

- Distributed Service Architecture
  - Custom Order Processing
  - Modular Software Components
  - Service Semantics
- Open, Distributed, Heterogeneous Data System
  - Improved Access and Use of Data and Information Products
  - Extends Online Data Distribution



http://datapool.nsstc.nasa.gov

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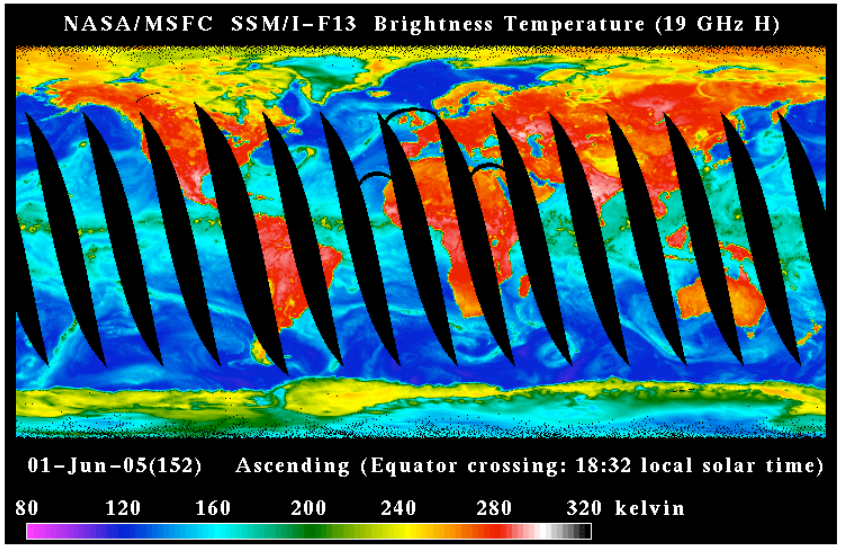
Data Pool Services Provide

- Improved access to online repositories
- Automated management and distribution
- Support of multiple interfaces
  - HTTP/FTP
  - OPeNDAP/DODS
  - OGC Web Services
  - Manual requests
- Automated electronic retrieval of data
- Automated order tracking/metrics
- Implementation across heterogeneous platforms



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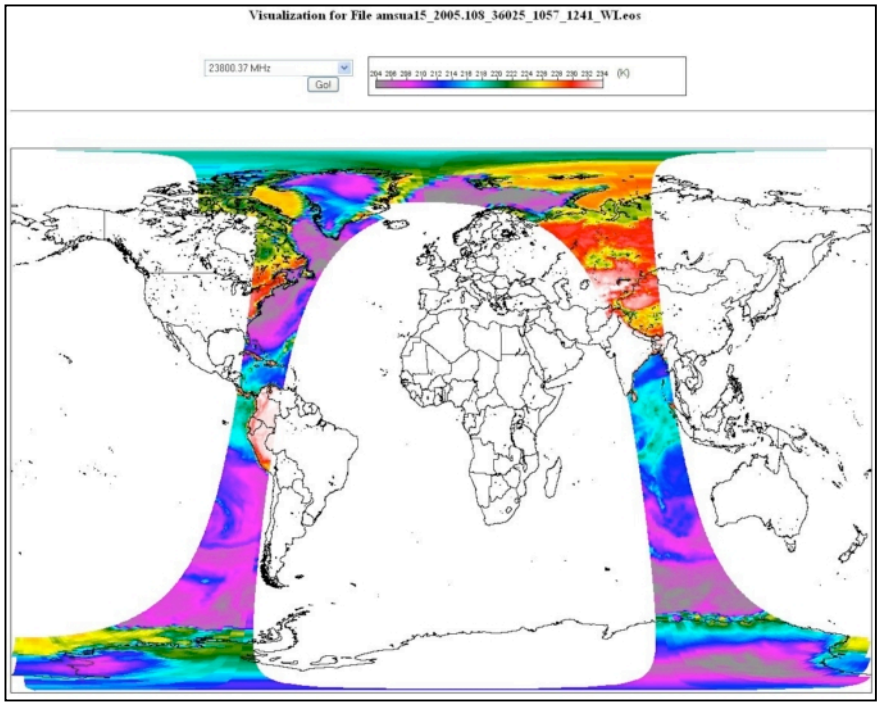
GHRC Data Pool Features

- Data Ingest through catalog services
- Search and Order Interfaces
- Order Tracking services
- Online Repository
- Subsetting
- Visualization through web mapping services
- Order broker
- Packaging services



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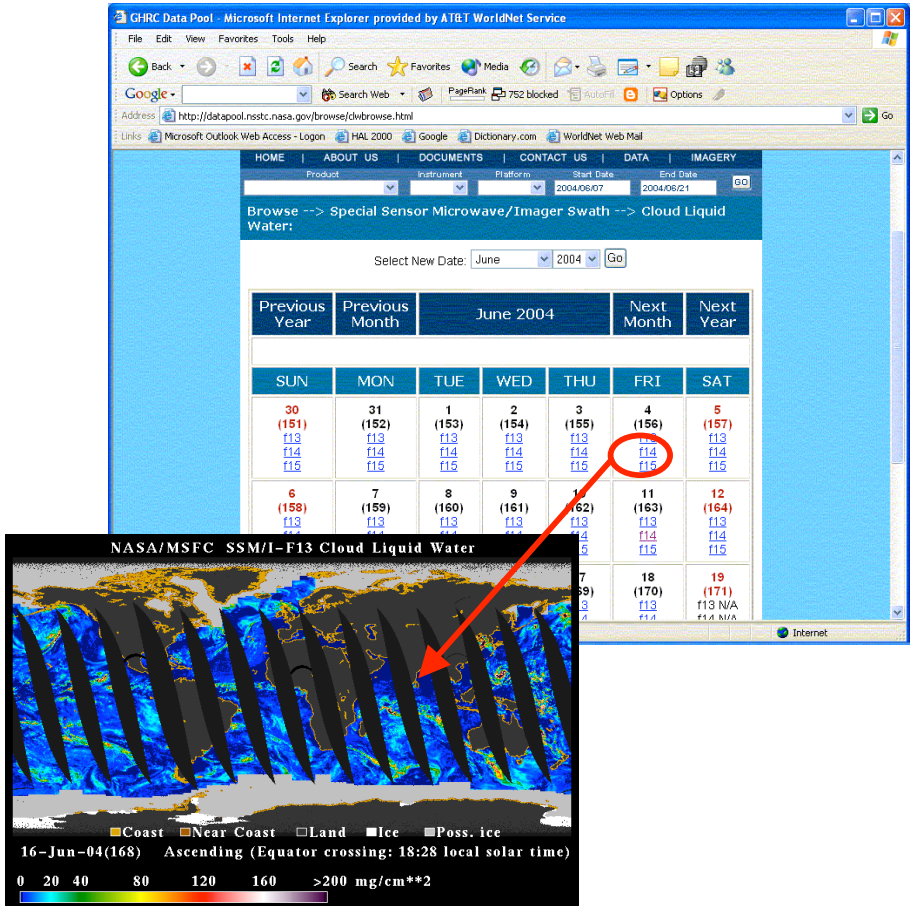
GHRC Data Pool Features

- On-line data access with integrated data services
- Automated ordering, visualization, packaging and delivery of scientific data
- Multiple distributed repositories at UAH and RSS
- Common user interface, data catalog and order tracking



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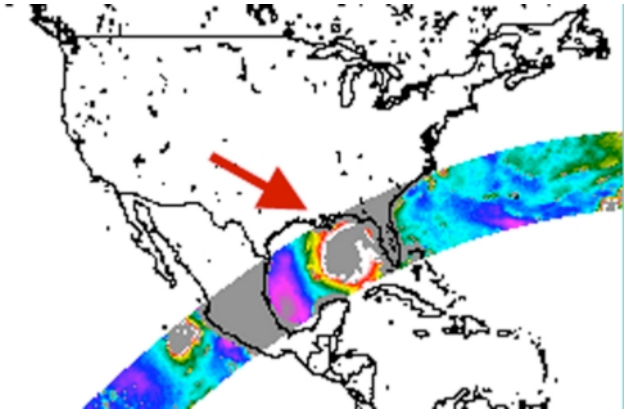
GHRC Data Pool Features

- Data Pool Navigation Options:
  - Search via keyword and geotemporal location
  - Browse via calendar
  - Browse data directories
  - Provides Unidata THREDDS catalog



- Data Access Services:
  - FTP and HTTP
  - OPeNDAP
  - OGC WMS and WCS
- Data Packaging Services:
  - Subsetting
  - Re-formatting
  - Bundling

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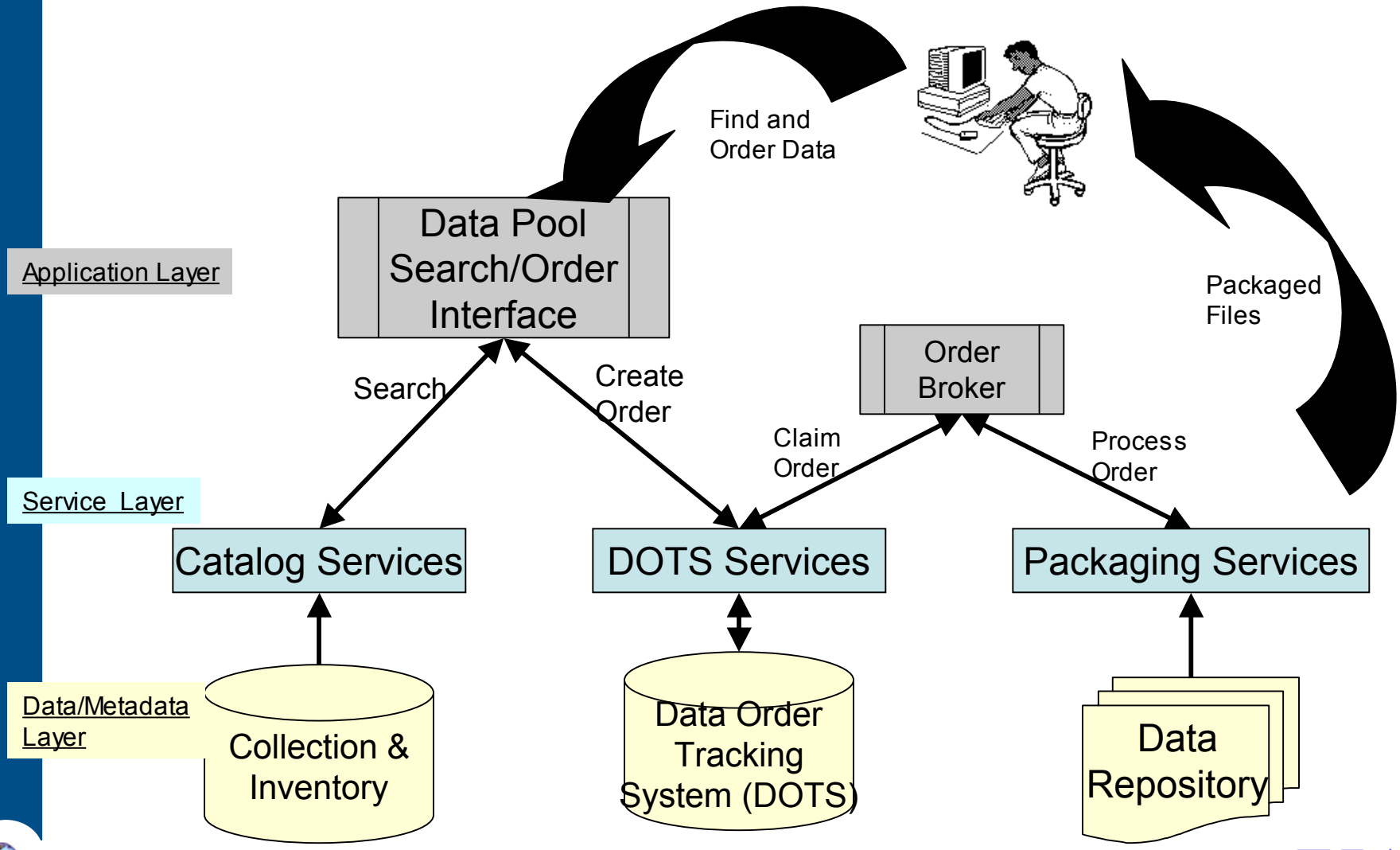
Data Pool Services Interactions



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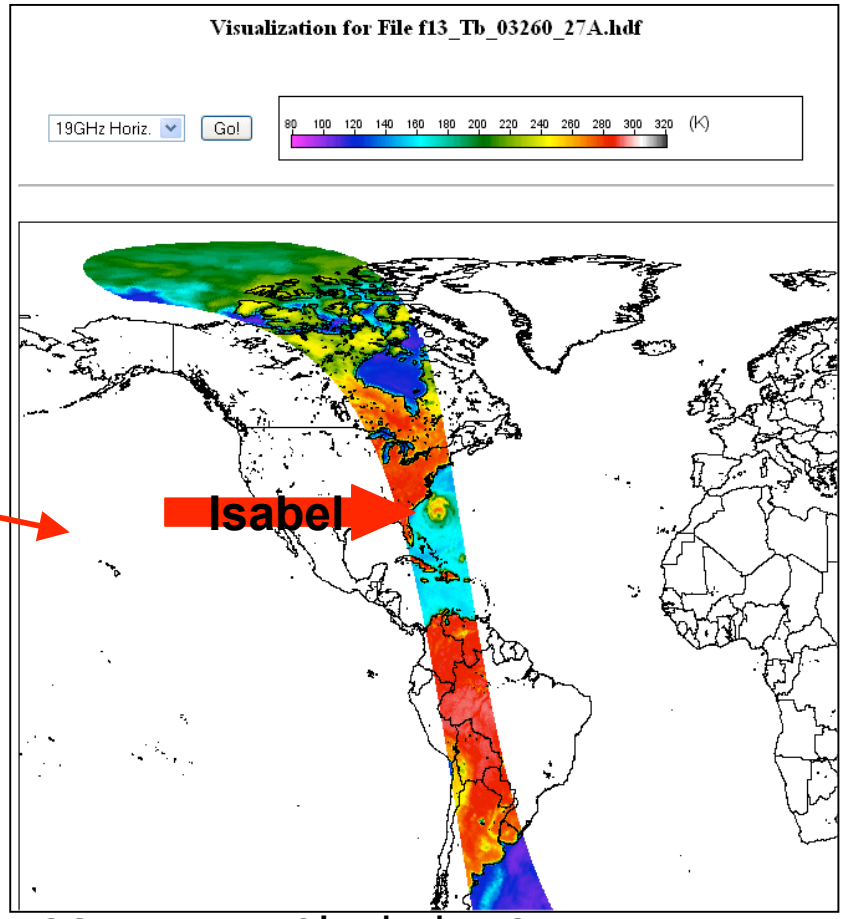
Integration of OGC Web Services



SSM/I View of Isabel in September 2003

Interactive, real-time browse images through use of OGC web mapping services

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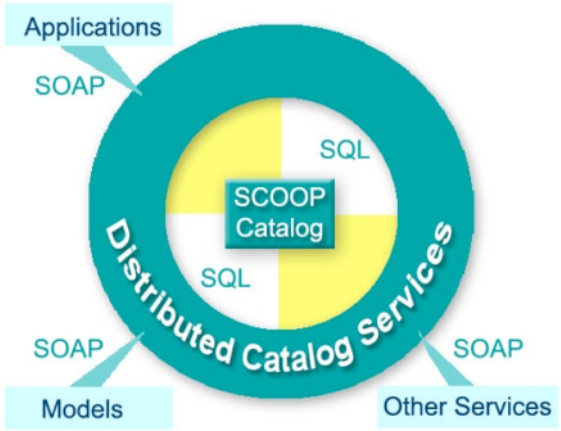
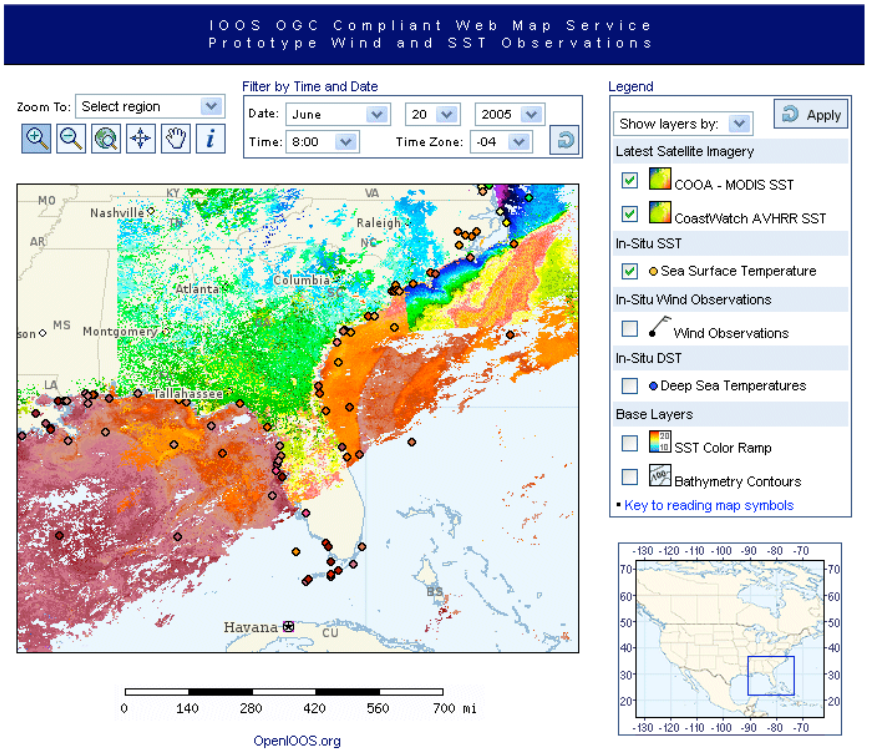
Technology Transfer Example

The SURA Coastal Ocean Observing and Prediction (SCOOP) program is incorporating many of the Data Pool approaches in the SCOOP Data System. Main enhancements include:

- Data Transport to users and archives via Unidata's Local Data Manager (LDM)
- Catalog services for all data management functions



http://www.itsc.uah.edu/scoop



http://www.openioos.org

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DISCOVER Information Products: Mining to Detect Tropical Cyclones

Advanced Microwave Sounding Unit (AMSU-A) Data

Calibration/ Limb Correction/ Converted to Tb

Data Archive

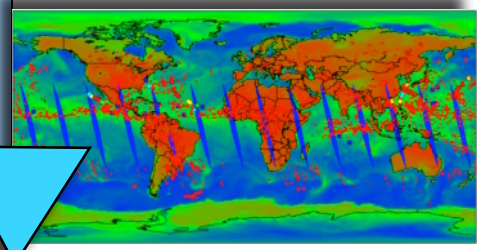
ADaM Mining Environment

Mining Plan:

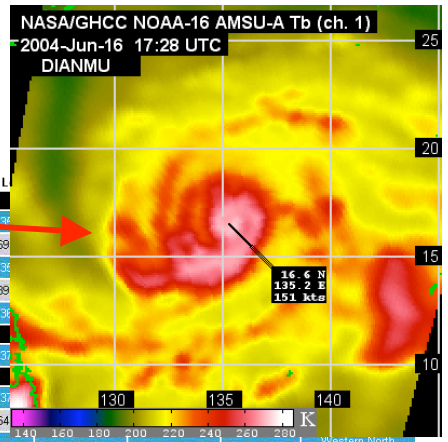
- Water cover mask to eliminate land
- Laplacian filter to compute temperature gradients
- Science Algorithm to estimate wind speed
- Contiguous regions with wind speeds above a desired threshold identified
- Additional test to eliminate false positives
- Maximum wind speed and location produced

Knowledge Base

Further Analysis



Result



Results are placed on the web, made available to National Hurricane Center & Joint Typhoon Warning Center, and stored for further analysis

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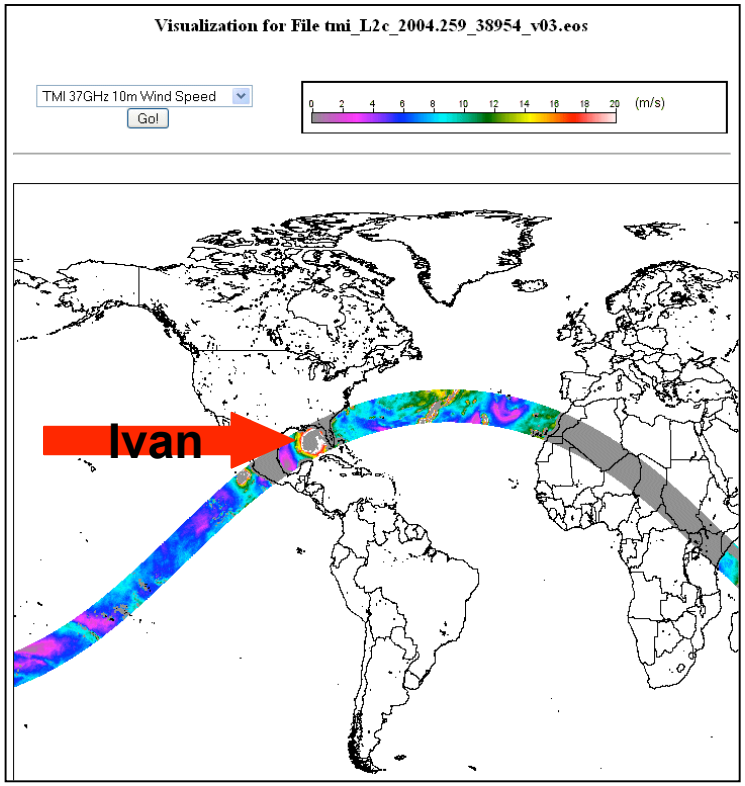
Conclusions

- Use of services to support distributed online repositories is effective.
- Distributed services insulate customers and applications from underlying computational systems
- Use of distributed services protect applications from ripples of underlying service changes
- Service use promotes the ability to scale systems across multiple repositories



TMI View of Ivan in September, 2004

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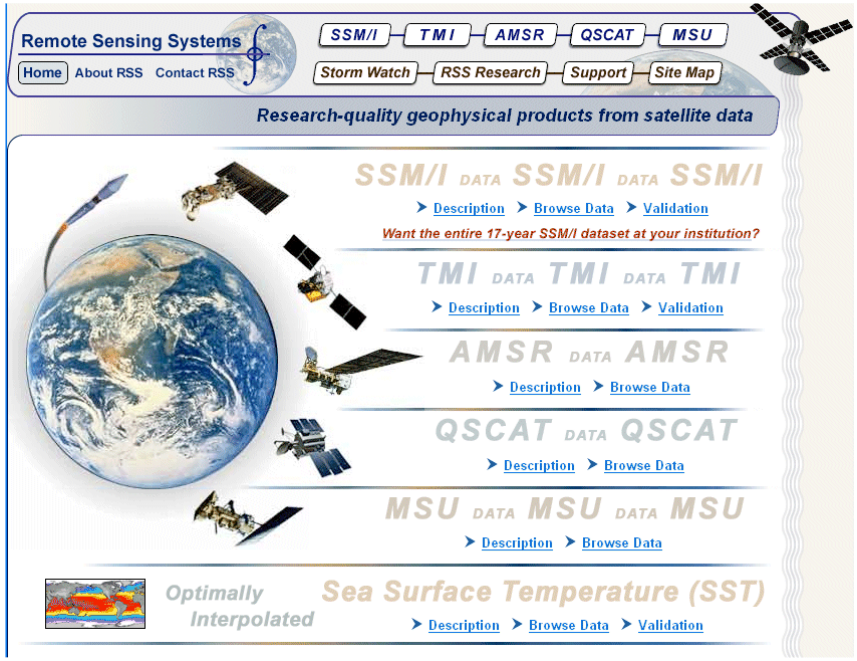
Next Steps

- Incorporate additional repositories
  - RSS datasets into GHRC catalog
- Provide additional services
  - OPeNDAP/ESML
  - WMS at RSS
- Provide GCMD entries for RSS datasets
- Investigate adaptation to other domains



http://www.remss.com

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OPeNDAP-ESML Data Server

- OPeNDAP data transport
  - Servers for each data type
  - Clients for each application
- ESML adds layer of abstraction to data server
  - Single ESML-OPeNDAP server for multiple data types
  - Simplifies set-up and maintenance for data provider
  - New OPeNDAP server not required if ESML already supports a data type that OPeNDAP doesn't – e.g., GeoTIFF
- Leveraging two maturing, NASA-funded technologies to provide added interoperability

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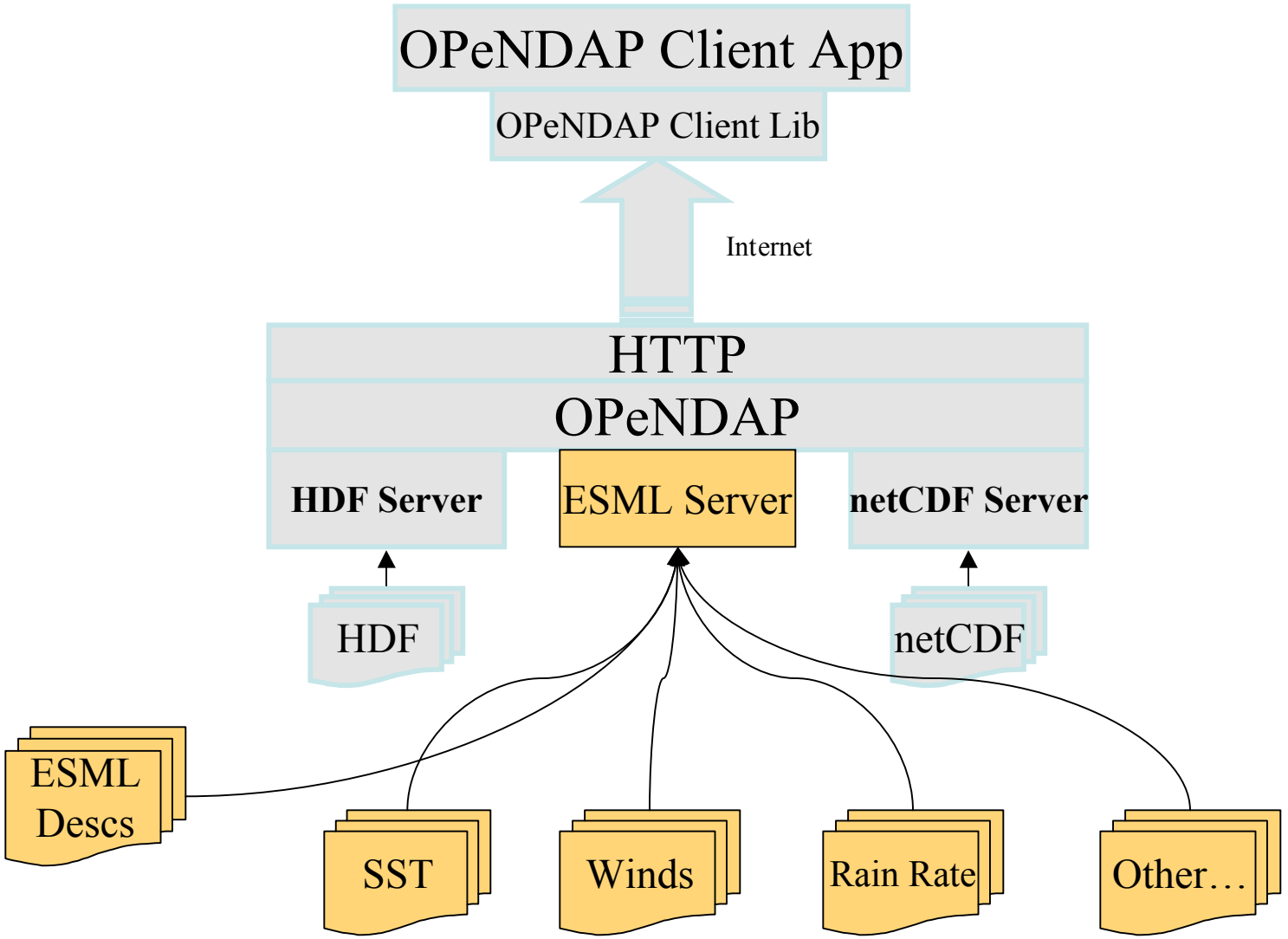
ESML-OPeNDAP Server



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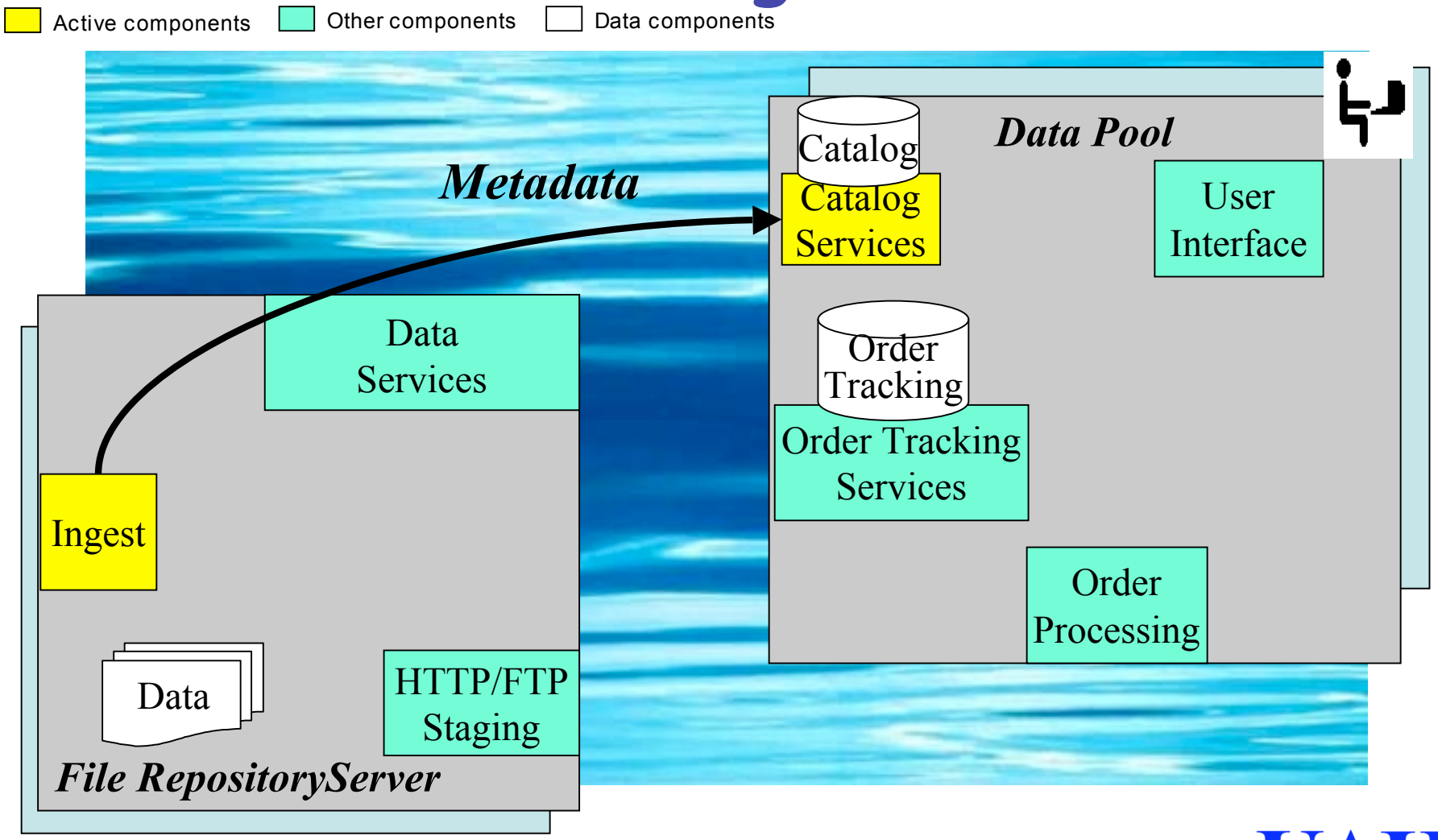
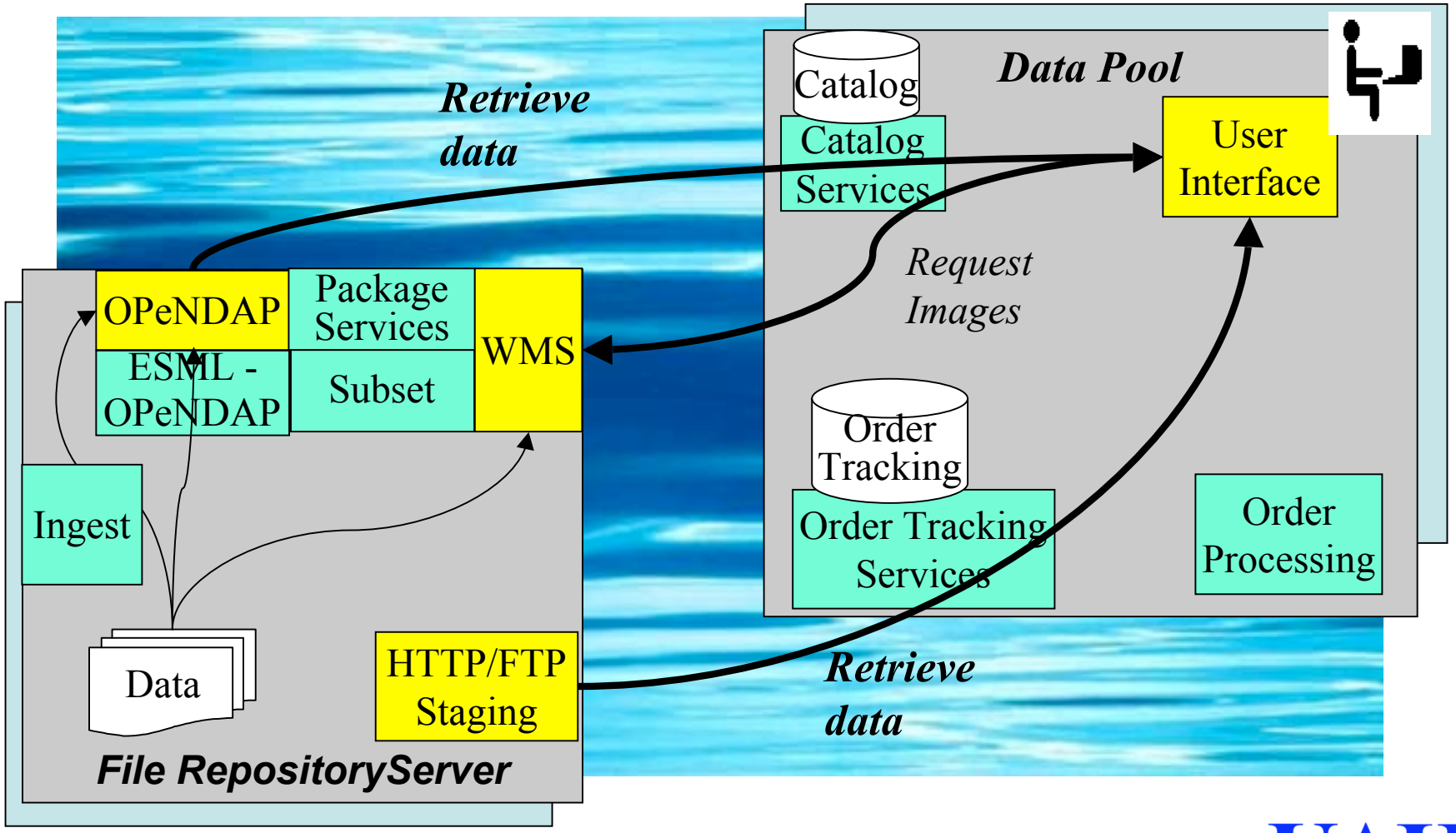
Data Pool – Architecture
Data Ingest



Data Pool – Architecture
Data Access



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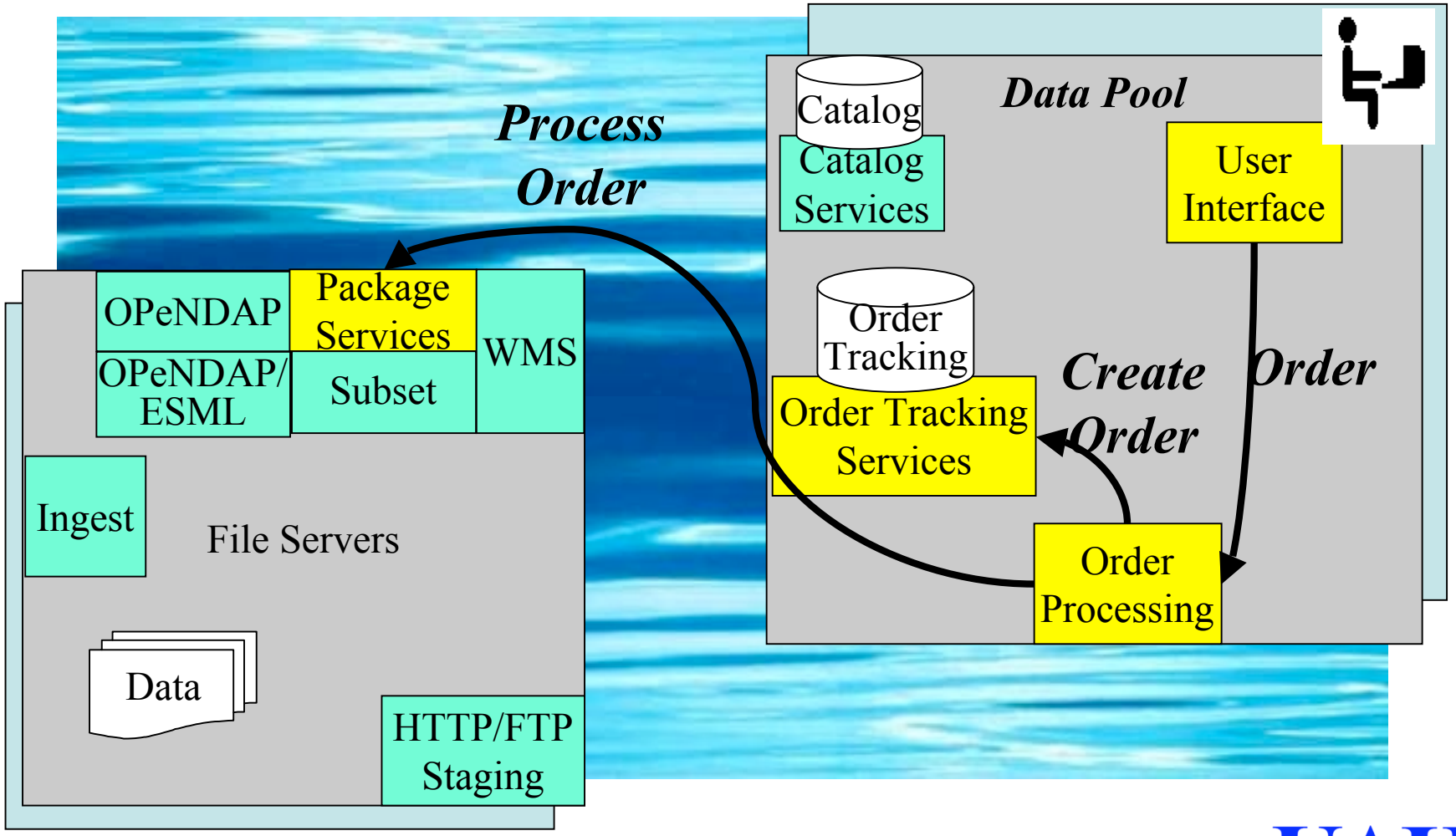
Data Pool – Architecture Generating Order Request



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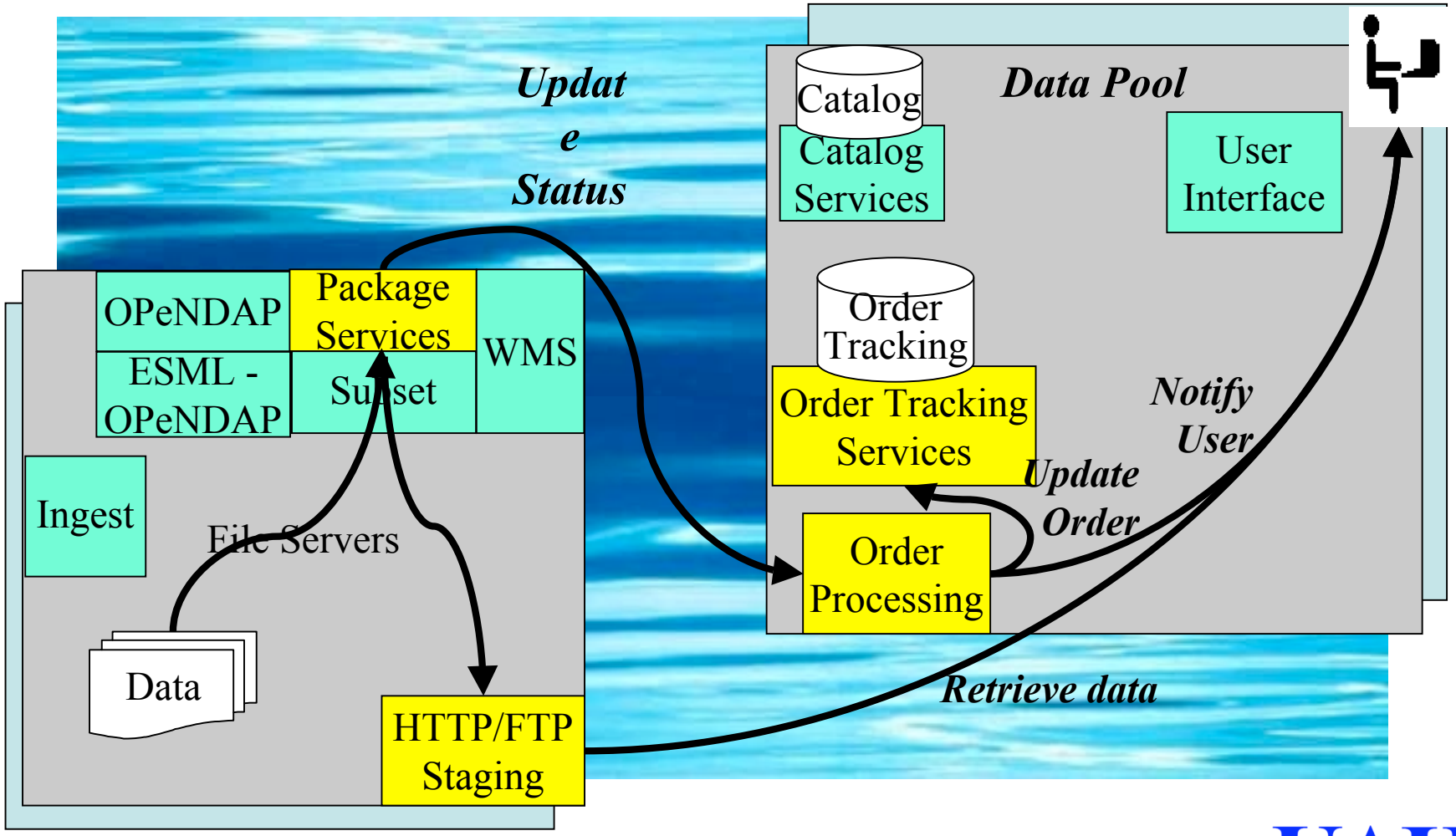
Data Pool – Architecture Processing Order



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